

Two Scan Heads are Better Than One: Integration of a Second Scan Pedestal for CoSMIR, CoSSIR, and/or HyMAS

Completed Technology Project (2015 - 2016)



Project Introduction

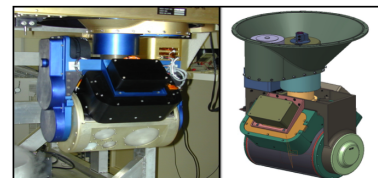
Simultaneous observations of atmospheric water vapor, temperature and clouds are essential to improving climate and weather models. Measurements of cloud ice and precipitation profiles and their microphysical properties are required to unravel the coupling between the Earth's hydrologic cycle (precipitation) and radiative energy budget processes. Understanding the coupling between clouds and precipitation, and Earth's energy budget and hydrological cycle are goals embedded within the Aerosol, Cloud, and Ecosystems (ACE) mission and the Cloud and Precipitation Process Mission (CaPPM). This IRAD bridges a critical gap in Goddard's airborne millimeter and submillimeter-wave cloud remote sensing by assembling a second scan pedestal for CoSMIR, CoSSIR, and HyMAS radiometers to operate jointly. The second scan pedestal will enable two of the three radiometers to fly concurrently, e.g. co-manifested on NASA's ER-2 research aircraft, providing an unprecedented range of microwave spectral coverage for cloud, precipitation, temperature and water vapor measurements. By demonstrating these capabilities on research aircraft, NASA will reduce the risk for deploying millimeter and submillimeter radiometers on future spaceflight missions.

The Compact Scanning Microwave Imaging Radiometer (CoSMIR) was originally developed as a calibration and validation instrument for the Defense Meteorological Satellite Program. CoSMIR has channels spanning 51 GHz and 183 GHz. Its novel azimuth over elevation dual-axes gimbals permit contiguous conical and across-track imaging with interleaved hot/cold calibration. CoSMIR currently serves as the Global Precipitation Mission (GPM) Microwave Imager (GMI) simulator.

The Compact Scanning Submm-wave Imaging Radiometer (CoSSIR) has channels spanning 183 GHz and 870 GHz and operates using the same scan pedestal as CoSMIR. CoSSIR has pioneered the application of submillimeter-wave radiometric sensing of ice clouds contributing vital data leading to the inclusion of the Ice Cloud Imager (ICI) on ESA's next generation MetOp satellite (due to launch in 2022). Its measurements were the impetus for selection of IceCube, a cubesat technology demonstration of 900 GHz receiver technology with a planned International Space Station release in 2016.

The Hyperspectral Microwave Atmospheric Sounder (HyMAS) is an Earth Science and Technology Office (ESTO) funded instrument developed in partnership with MIT Lincoln Laboratory and is designed to use the CoSMIR/CoSSIR scan pedestal. HyMAS is a highly innovative hyperspectral sounder with fifty-two channels spanning the 118 GHz oxygen and 183 GHz water vapor lines. The completion of integration and laboratory testing is anticipated to be complete in September 2015.

At present, there is only one pedestal that accommodates the CoSMIR, CoSSIR, and HyMAS scanheads. These instruments cannot be flown together since they share the same infrastructure; the scan pedestal includes basic



CoSMIR on the original pedestal (left) and a rendering of the new pedestal (right)

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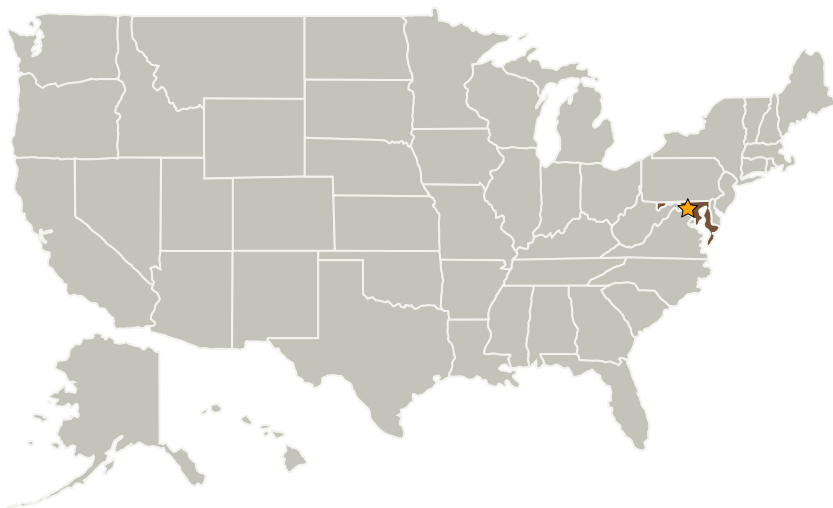


mounting of the scan head, the scanning mechanism and control electronics (conical and cross-track), two blackbody calibrators and calibration/house keeping computer, aircraft interface, and data acquisition and systems.

Anticipated Benefits

This project supports the development of instrumentation and algorithms to be used by NASA's planned Aerosol, Cloud, and Ecosystems (ACE) mission and the Cloud and Precipitation Process Mission (CaPPM).

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Goddard Space Flight Center (GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

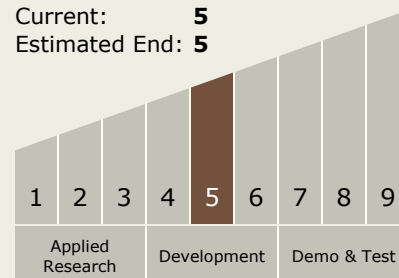
Matthew J McGill

Principal Investigator:

Mathew R Schwaller

Technology Maturity (TRL)

Start: 5
Current: 5
Estimated End: 5

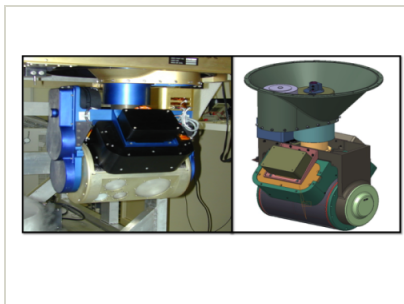


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Images



Scan Pedestal for CoSMIR, CoSSIR, and HyMAS

CoSMIR on the original pedestal (left) and a rendering of the new pedestal (right)

(<https://techport.nasa.gov/image/19143>)

Project Website:

<http://aetd.gsfc.nasa.gov/>

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves